Notice of Allowability	Application No.	Applicant(s)	
	10/816,179	LEE ET AL.	
	Examiner	Art Unit	
	Rudy Zervigon	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the August 3, 2007 interview*.

2. ☒ The allowed claim(s) is/are *1-24 and 26-33*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 11/13/6;10/1/4
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date *20070805* .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

1. An extension of time under 37 CFR 1.136(a) is required in order to make an examiner's amendment which places this application in condition for allowance. During a telephone conversation conducted on August 2nd, 3rd, 2007, M. Mathews Hall requested an extension of time for 3 MONTH(S) and authorized the Director to charge Deposit Account No. 503397 the required fee of $510 for this extension and authorized the following examiner's amendment. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

The application has been amended as follows:

IN THE CLAIMS:

1. (Currently amended) A system for depositing a composite polymer dielectric film on a substrate, the composite polymer dielectric film including a low dielectric constant polymer layer disposed between and chemically bonded to a first silane-containing layer and a second silane-containing layer, the system comprising: a process module including a processing chamber, a source of monomer containing a monomer having a general formula of X'_m–Ar–$(CZ'Z''Y')_n$, wherein Ar is an aromatic group or a fluorine-substituted aromatic group, wherein Z' and Z'' are selected from the group consisting of H, F, and C_6H_5, wherein X' and Y' are leaving groups removable to generate free radicals, wherein m and n are each equal to zero or an integer, and wherein m + n is less than or equal to a total number of sp^2 hybridized carbons on Ar available for substitution, and a monomer delivery system configured to remove the leaving groups and to deliver the monomer in a gas phase into the processing chamber for deposition of the low

dielectric constant polymer layer; a post-treatment module for annealing the composite polymer dielectric film; a silane delivery system configured to deliver a vapor flow containing a silane precursor into the system for forming the first silane-containing layer and the second silane-containing layer; memory and a processor in electrical communication with the process module, the post-treatment module and the silane delivery system; and instructions stored on the memory and executable by the processor to control the silane delivery system to deposit the silane precursor on the substrate for a first interval to form the first silane-containing layer, next to control the process module to deposit the gas phase monomer on the first adhesion promoter silane-containing layer for a second interval to form the dielectric constant polymer layer, and next to control the silane delivery system to deposit the silane precursor on the low dielectric constant polymer layer for a third interval to form the second silane-containing layer.

2. (Original) The system of claim 1, wherein the silane delivery system is configured to deliver the silane precursor to a silane deposition module that includes a silane deposition chamber and a free radical-generating energy source, and wherein the instructions are executable by the processor to control an exposure of the silane precursor to energy from the energy source to form free radicals in the silane precursor after depositing the silane precursor on the substrate for the first interval.

3. (Original) The system of claim 2, wherein the free-radical generating energy source is a UV light source.

4. (Original) The system of claim 2, wherein the free-radical generating energy source is a thermal energy source.

5. (Original) The system of claim 2, wherein the free-radical generating energy source is a plasma source.

6. (Original) The system of claim 1, wherein the silane delivery system is configured to deliver the silane precursor to the process module.

7. (Original) The system of claim 1, wherein the silane delivery system is configured to deliver the silane precursor to the post-treatment module.

8. (Original) The system of claim 1, wherein the post-treatment module includes a heater for heating the substrate, and wherein the instructions are executable by the processor to anneal the composite dielectric layer in a presence of hydrogen in the post-treatment module via the heater after depositing the silane precursor on the low dielectric constant polymer layer for the third interval.

9. (Original) The system of claim 8, wherein the heater is a hot plate.

10. (Original) The system of claim 8, wherein the instructions are executable by the processor to anneal the composite dielectric layer in a presence of 3-10% H_2 in He.

11. (Original) The system of claim 8, wherein the instructions are executable to anneal the composite dielectric layer at a temperature of between approximately 250 and 450 degrees Celsius.

12. (Original) The system of claim 8, wherein the instructions are executable to anneal the composite dielectric layer for a duration of between approximately 2 and 10 minutes.

13. (Original) The system of claim 1, wherein the process module includes a cooled substrate holder, and wherein the instructions are executable to hold the substrate at a temperature below

the crystallization temperature of low dielectric constant polymer layer while depositing the gas phase monomer.

14. (Original) The system of claim 13, wherein the instructions are executable to hold the substrate at a temperature of between approximately -25 and -55 degrees Celsius while depositing the gas phase monomer.

15. (Original) The system of claim 13, wherein the cooled substrate holder is an electrostatic chuck.

16. (Original) The system of claim 15, the chuck having a surface, wherein up to 10 psi of helium is disposed between the substrate and the surface of the chuck during substrate cooling to aid in cooling the substrate.

17. (Original) The system of claim 1, wherein the instructions are executable to hold the substrate at a temperature of approximately 25 degrees Celsius or below while depositing the silane precursor.

18. (Original) The system of claim 1, wherein the post-treatment module includes an annealing chamber, a vacuum pump system, a mass flow controller, and at least one valve controlling a flow of gas into the annealing chamber, and wherein the instructions are executable to hold an atmosphere within the annealing chamber at a pressure of between approximately 1 and 10 Torr via the vacuum pump and the valve.

19. (Original) The system of claim 1, wherein the post-treatment module includes a substrate elevator and a plurality of heating elements for batch substrate processing.

20. (Original) The system of claim 1, wherein the first silane-containing layer is a first adhesion promoter layer configured to chemically bond to an underlying silicon-containing layer.

21. (Original) The system of claim 1, wherein the second silane-containing layer is a hard mask layer.

22. (Original) The system of claim 1, wherein the second silane-containing layer is an etch stop layer.

23. (Original) The system of claim 1, wherein the second silane-containing layer is a second adhesion promoter layer configured to chemically bond to an overlying silicon-containing layer.

24. (Currently amended) A system for depositing a composite polymer dielectric film on a substrate, the composite polymer dielectric film including a low dielectric constant polymer layer disposed between a first adhesion promoter layer and an overlayer, wherein the overlayer includes at least one layer selected from the group consisting of a second adhesion promoter layer, an etch stop layer and a hard mask layer, wherein the first adhesion promoter layer includes reactive silane groups configured to chemically bond to a silicon-containing layer that is in contact with the adhesion promoter layer, the system comprising: a process module for forming the low dielectric constant polymer layer, wherein the process module includes a deposition chamber and a substrate holder configured to hold and cool a substrate during a deposition process; a source of monomer containing a monomer having a general formula of X'_m–Ar–$(CZ'Z''Y')_n$, wherein Ar is an aromatic group or a fluorine-substituted aromatic group, wherein Z' and Z'' are selected from the group consisting of H, F, and C_6H_5, wherein X' and Y' are leaving groups removable to generate free radicals, wherein m and n are each equal to zero or an integer, and wherein m + n is less than or equal to a total number of sp^2 hybridized carbons on Ar available for substitution, and a monomer delivery system comprising ~~a polymer film precursor~~ the source of monomer in communication with the deposition chamber, and a reactor

positioned between and in communication with ~~the precursor source~~ the source of monomer and the deposition chamber for delivering ~~a gas phase diradical~~ the monomer to the deposition chamber; a post-treatment module for annealing the composite polymer dielectric film, wherein the post-treatment module includes a heat source for heating the substrate and processing gas delivery system for delivering a reducing gas to the post-treatment module; a silane deposition module for depositing the first adhesion promoter layer and the overlayer, wherein the silane deposition module includes a silane deposition chamber and a silane delivery system for delivering a silane precursor to the silane deposition chamber; a transfer module disposed between the process module, the silane deposition module and the post-treatment module, wherein the transfer module includes a substrate transport mechanism for transferring a substrate between the process module and the post-treatment module, memory and a processor in electrical communication with the process module, the post-treatment module and the silane delivery system and instructions stored on the memory and executable by the processor to hold the substrate at a temperature of at least as low as -25 degrees Celsius while depositing the gas phase monomer.

25. (Cancelled)

26. (Original) The system of claim 24, wherein the instructions executable by the processor to hold the substrate at a temperature of between -30 and -50 degrees Celsius while depositing the gas phase monomer.

27. (Original) The system of claim 24, wherein the substrate holder includes a cooling mechanism configured to cool the substrate when the substrate is in the holder.

28. (Original) The system of claim 27, wherein the substrate holder is an electrostatic chuck configured to allow a pressure of 10 psi or less of helium to be held between the chuck and the substrate to aid in cooling the substrate.

29. (Previously presented) The system of claim 24, wherein the reactor is configured to generate a diradical monomer from the precursor.

30. (Original) The system of claim 29, wherein the monomer delivery system includes a vapor flow controller disposed between the vessel and the reactor.

31. (Original) The system of claim 24, wherein the silane delivery system includes an inert gas supply, a mass flow controller, and a silane vessel for containing and heating a volume of a silane precursor.

32. (Original) The system of claim 24, wherein the post-treatment module includes a hot plate for heating the substrate during annealing.

33. (Original) The system of claim 24, further comprising a first load lock and a second load lock coupled to the transfer module, wherein the first load lock is configured to accept insertion of a substrate into the system, and wherein the second load lock is configured to permit removal of a substrate from the system.

34-49. (Cancelled)

Allowable Subject Matter

2. Claims 1-24, and 26-33 are allowed.

3. The following is a statement of reasons for the indication of allowable subject matter: None of the closest prior art references to Moghadam, Farhad et al. (US 20030232495 A1), Noble; David B. et al. (US 6450116 B1), or Shinriki; Hiroshi et al. (US 6806211 B2), teach or

suggest the above independent claim 1 and 24 amendments combined with the claim requirements as a whole. Specifically, none of the above references suggest the structural "source" of monomer and associated chemical attributes. Additionally, with respect to claim 1, Applicant's interview of August 2 and 3 convinced the Examiner that the function of the claimed structure "instructions stored on the memory and executable by the processor" *is* functional descriptive (2106.01) and are not intended use elements as the Examiner previously argued. See the 2/7 final rejection page 18.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

US 6130171 A

US 5925420 A

US 5841005 A

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (571) 272-1442. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official fax phone number for the 1763 art unit is (571) 273-8300. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (571) 272-1700. If the examiner can not be reached please contact the examiner's supervisor, Parviz Hassanzadeh, at (571) 272-1435.